Terminal drought and rotational cropping sequence effects on irrigated barley in conventional and conservation managed approaches

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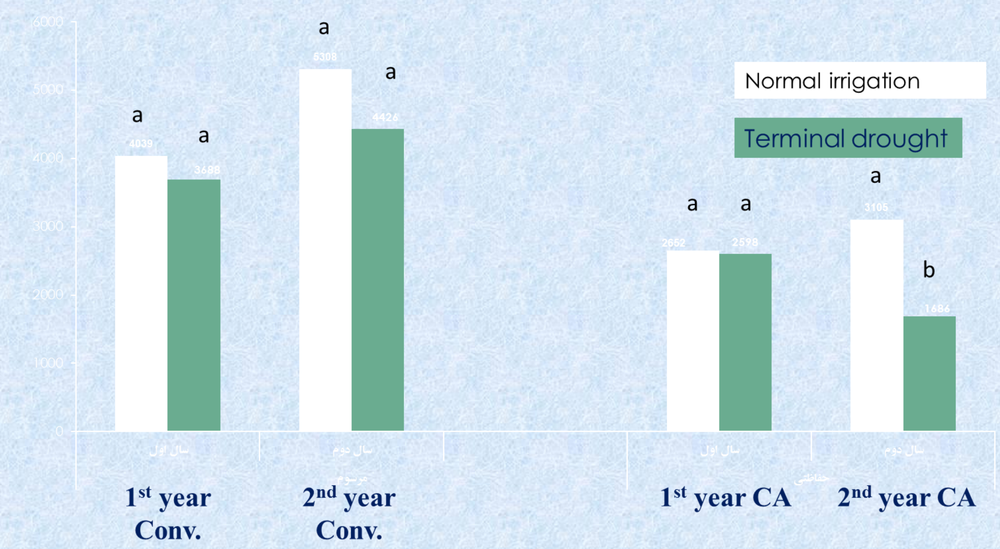
Introduction

Less favorable environments of crop production are dominantly occurring across the irrigated wheat lands of Iran because of the high vapor pressure deficit caused by atmospheric low relative humidity putting irrigated wheat in water shortage pressure during its growth stages. While, Terminal drought as one main unavoidable managed approach in irrigated wheat lands in Iran may be used by the local farmers, because of the water shortage in late growth stages of irrigated wheat and its coincidence with irrigation water needed by other spring grown cash crops in which the final result would be wheat grain yield loss comparing to the full irrigation regime. In this two year experiment the CA as a holistic collection of managed approaches to use natural resources more efficiently was evaluated to minimize the referred loss. The role of CA in long term is to indirectly upgrade soil tilth and fertility especially organic matter to reserve water for a more period of time lessening the water shortages caused by terminal drought through its sensitive period of grain filling.

Methods & materials

This experiment was done for two cropping years including two experiments of conventional and conservation based separately analyzed by split plot design in RCBD with four replicates studying six demonstration plots as diverse crop sequences including local dominant crop sequence of wheat/maize double cropping comparing to other 5 crop sequences as main plots and irrigation regimes of normal irrigation and terminal drought as sub plots.

Figure 1. Grain yield mean comparison of barley cv. Yousef in normal irrigation and terminal drought conditions and conventional and conservation managed approaches



Terminal drought in irrigated barley cv. Yousef is recommended for both conventional and conservation approaches

The best successful crop sequence for conventional approach is: barley/maize-barley/maize

The best successful crop sequence for conservation approach is: barley/berseem-canola/maize

Table 1 De Martonne (1926) aridity index and climate classification

Province	Mean annual precipitation	Mean annual temperature	Crop coefficient	De Martonne climate classification	Annual mean evaporation	ASL
Markazi	337.08	13.9	14.1	Semi arid	2300	1708
Ardebil	295.56	9.2	15.4	Semi arid	1300	1338
West Azarbaijan	338.88	11.6	15.7	Semi arid	1650	1363
Isfahan	125.04	16.3	4.8	Arid	2800	1570
Khuzestan	209.16	25.4	5.9	Arid	3400	10
Ilam	583.68	16.9	21.7	Mediterranean	3655	1387
North Khorasan	267.84	13.3	11.5	Semi arid	2042	1086
Hormozgan	176.16	27	4.8	Arid	3600	9
bushehr	267.96	24.7	7.7	Arid	3416	4
South Khorasan	168.48	16.5	6.4	Arid	2565	1444
East Azarbaijan	283.8	12.6	12.6	Semi arid	1263	1345
Tehran	232.68	17.4	8.5	Arid	2500	1368
Lorestan	504.36	17.2	18.5	Semi arid	2080	1347
Gilan	1337.52	16	51.4	Very humid	2061	4
Zanjan	311.16	11.1	14.7	Semi arid	2178	1638
Mazandaran	789.24	17.9	28.3	Humid	1900	54
Semnan	140.76	18.2	5	Arid	2000	1130
Kordestan	449.88	13.6	19.1	Semi arid	1341	1463
Sistan & Baluchestan	89.28	18.5	3.1	Arid	4000	1344
Chahar mohal & Bakhtiari	321.84	11.7	14.8	Semi arid	1500	2060
Fars	334.68	17.8	12	Semi arid	2650	1519
Qazvin	314.4	14.1	13	Semi arid	2000	1279
Qom	148.2	18.2	5.3	Arid	2700	932
Alborz	251.76	15.1	10	Semi arid	2184	1320
Kerman	147.96	15.9	5.7	Arid	3000	1756
Kermanshah	439.2	14.4	18	Semi arid	1900	1374
Golestan	583.8	17.8	21	Mediterranean	1321	174
Razavi Khorasan	251.52	14.3	10.4	Semi arid	2226	1065
Hamedan	317.76	11.4	14.8	Semi arid	1504	1741
Kohgiluye & Boyerahmad	823.32	15.2	32.7	Humid	2073	1816
Yazd	59.16	19.2	2	Arid	4211	1230

Based on the information in table above, from the total of 31 provinces in Iran, 11 provinces are categorized as arid, 15 as semi arid, 2 as Mediterranean, 2 as humid and just 1 as very humid. So, 26 provinces are in arid and semiarid categories which is a reminder of us to quick implementation of conservation based irrigated cropping systems with two specialties of economical and environmental friendly.

Results & conclusions

Although terminal drought had 8% barley grain yield reduction in conventional approach and 2% grain yield reduction in conservation approach but neither were significant.

The 2nd year Terminal drought in conventional approach had 17% a significant barley grain yield reduction ($p<0.01$).

The intrinsic drought resistance of barley as a terminal drought resistant crop was the main reason for observing a two years non-significant effect of terminal drought in conventional approach.

The reduction in negative effect of terminal drought on barley grain yield in conservation (2%) vs. conventional (9%) approaches may be due to the continuous implementation of conservation approach for the 4th year.

In the 2nd year that was the 5th year of the implementation of conservation approach, barley grain yield in conservation approach had a 45% reduction which is due to the traffics related to all the crops in sequence for 4 years past causing soil compaction reducing soil aeration with final results above and underground growth reduction.